

REMARKS

This amendment responds to the Official Action mailed October 10, 1996. The shortened statutory period of response is set to expire January 10, 1996. Accordingly, applicant respectfully submits that this response is being timely filed.

Claims 3-12 and 14-26 were pending. In this submission, claims 5-12, 16, 19, and 26 have been amended in order to more clearly define protection to which applicant is entitled. Claims 3, 4, 14, 15, 17, 18, and 20-25 have been cancelled without prejudice or disclaimer, and new claims 27-48 are submitted for examination on the merits. Accordingly, claims 5-12, 16, 19, and 26-48 are currently pending in the present application and, for the reasons set forth below, are believed to be in condition for allowance.

PRIOR ART REJECTIONS

The Official Action rejects claims 3-8, 11-12 and 14-25 as obvious over Japanese Patent No. 2-140915 to Oak in view of U.S. Patent No. 5,147,826 to Liu et al., as of record. This rejection is respectfully traversed in view of the above amendments, and reconsideration is respectfully requested based on the following remarks.

Oak teaches forming a metal layer on an amorphous silicon layer and heating the layers to form a crystal nucleus in the amorphous silicon layer. Oak further teaches removing the metal layer after the formation of the crystal nucleus and further heating the silicon layer to grow crystals from the crystal nucleus. However, Oak does not appear to disclose the composition of the crystal nucleus, such as whether it is comprised of a crystal silicon or a crystal

metal silicide. In either case, Oak does not teach to perform the crystallization of the silicon layer using the diffusion of a metal. In fact, Oak discloses that the reason for eliminating the metal layer is to prevent the abnormal diffusion of the metal into the amorphous silicon during heat treatment (see page 7, lines 7-11 of the translation of Oak). Oak teaches using a metal to merely form the crystal nucleus in the silicon layer.

The claims of the present invention have been amended to recite that the crystallization of the semiconductor film proceeds in a direction parallel to a major surface of the substrate from a catalyst deposited region with diffusion of the catalyst through the semiconductor film. Further, the claims of the present invention recite that the concentration of the catalyst in the crystallized region of the semiconductor film is 1×10^{19} atoms/cm³ or lower. As described from page 8, line 30 to page 9, line 10 and on page 7, lines 15-28 of the present application, the Applicants have discovered that the crystallization proceeds with the diffusion of the metal through the semiconductor film. Therefore, it is imperative to control the concentration of the metal in the semiconductor film in order to control the function of the metal as a catalyst for crystallization and further in order to avoid lowering the reliability of the device. Since neither Oak or Liu et al. recognizes that the crystallization of the semiconductor layer proceeds with the diffusion of the metal, there is no motivation provided by the teachings of these references to select the catalyst concentration range of the presently claimed invention. Accordingly, one skilled in the art would not be motivated by the combination of Oak and Liu et al. to yield the present invention, and reconsideration is respectfully requested.

The Official Action rejects claims 9-10 as obvious over Oak in view of

Liu et al. and further in view of U.S. Patent 5,278,093 to Yonehara or U.S. Patent No. 4,309,224 to Shibata et al., as of record. Since claims 9-10 now ultimately depend upon new independent claim 27 and 29, Applicants respectfully traverse this rejection for the same reasons set forth above that one skilled in the art would not be motivated to combine the above references to provide a catalyst having a concentration not greater than 1×10^{19} atoms/cm³, wherein the crystallization proceeds in a direction parallel to a major surface of the substrate from the catalyst deposited region with diffusion of the catalyst through the semiconductor film. Reconsideration is requested.

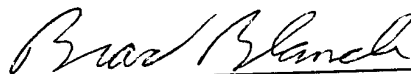
The Official Action rejects claim 26 as obvious over Oak in view of Liu et al. and further in view of Kuznetsov et al. (Microsc. Semicond. Mater. Conf. '93). This rejection is respectfully traversed in view of the above amendment, and reconsideration is requested based on the following remarks.

The Official Action admits that Oak and Liu et al. do not teach SIMS testing of the metal concentration. The Official Action asserts that Kuznetsov et al. teaches determining the Ni concentration in metal induced crystallized silicon using SIMS. The Official Action asserts that it would have been obvious to test the metal induced crystallized silicon of Oak to check for the presence of and to determine the distribution of deleterious metal impurities as taught by Kuznetsov et al. However, Kuznetsov et al. further fails to disclose the claimed catalyst concentration of lower than 1×10^{19} atoms/cm³. Therefore, not only does the combination of prior art fail to produce the claimed invention, since none of the prior art references appear to recognize that the crystallization proceeds with the diffusion of the metal, there is no motivation provided by the references to yield the claimed invention. Reconsideration is requested.

CONCLUSION

In each case, the pending rejections should be reconsidered in view of the amendments and remarks herein. Applicants believe that this case is in good condition for allowance, and a Notice of Allowance is earnestly solicited. If a telephone or further personal conference would be helpful, the Examiner is invited to call the undersigned, who will cooperate in any appropriate manner to advance prosecution.

Respectfully submitted,



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